IS 7071-1 to 3 (1989): Ropes and Cordages - Methods of Physical Test [TXD 1: Physical Methods of Tests]

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(Reaffirmed 2004)

Indian Standard

ROPES AND CORDAGES — METHODS OF PHYSICAL TEST

(First Revision)

भारतीय मानक

रस्सी और कार्डेज भौतिक परिक्षण पद्धति

(पहला पुनरीक्षण)

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Price Group 3

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards on 20 April 1989, after the draft finalized by the Physical Methods of Test Sectional Committee had been approved by the Textile Division Council.

This standard, first published in 1974, has been revised to take care of the developments which have taken place during this period. Opportunity has also been taken to align this standard with other Indian Standards on ropes and cordage published subsequently.

In the preparation of this standard, considerable assistance has been derived from ISO 2307-1972 'Ropes — Determination of certain physical and mechanical properties', issued by the International Organization for Standardization (ISO).

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*).'

Indian Standard

ROPES AND CORDAGES — METHODS OF PHYSICAL TEST

(First Revision)

1 SCOPE

1.1 This standard lays down methods for determination of mass, linear density, length, diameter, circumference and lay of ropes and cordages made from natural and man-made fibres, as well as prescribes the relevant definitions of terms.

2 REFERENCES

2.1 The following Indian standards are necessary adjuncts to this standard.

IS No.	*Title*
IS 232 : 1985	Glossary of textile terms — Natural fibres (*second revision*)
IS 3871 : 1984	Glossary of terms relating to fibre ropes and cordages (*second revision*)
IS 6359 : 1971	Methods for conditioning of textiles

PART 1 GENERAL

3 TERMINOLOGY

3.1 For terms other than those covered in this standard, reference shall be made to IS 3871 : 1984 and IS 232 : 1985.

3.2 Angle of Lay

The angle which a strand of rope makes with the axis of the rope (*see* Fig. 1).

3.3 Atmospheric Conditions for Testing (Standard)

The atmosphere in which physical tests on textile materials are performed. It has a relative humidity of 65 ± 2 percent and a temperature of 27 ± 2°C (*see also* IS 6359 : 1971).

3.4 Breaking Length

The length of a specimen of uniform area of cross section (such as, rope, line, cord, twine or yarn) the mass of which is equal to its breaking load, that is, the length of a specimen which will break due to its own weight when suspended freely from one of its ends.

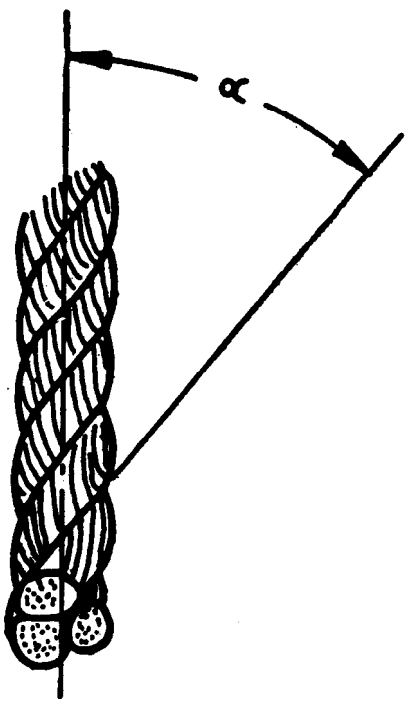

FIG. 1 ANGLE OF LAY

NOTE — The breaking length expressed in kilometres is numerically equal to the breaking tenacity expressed in grams per tex.

3.5 Breaking Load

The maximum load or force supported by a specimen in a tensile test carried to rupture. It is commonly expressed in 'grams force' or 'kilograms force'.

3.6 Coil

A continuous length of rope or line arranged in the form of a spiral.

3.7 Cordage

All kinds of ropes, lines, cords and twines manufactured from natural or man-made fibres.

3.8 Elongation

In a tensile test, the difference between the length of the stretched cordage and its initial length, usually expressed as a percentage of initial length.

3.9 Length of Lay

Distance between two successive spirals of the same strand of a rope measured parallel to the axis of a rope (*see* Fig. 2).

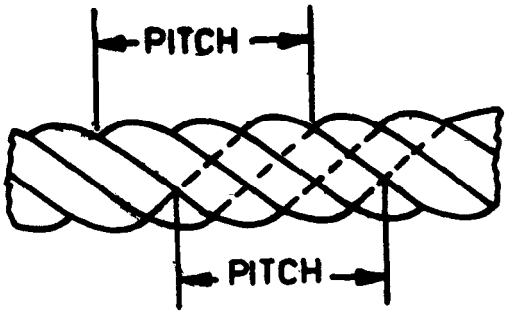

FIG. 2 LAY OR PITCH OF ROPE

3.10 Linear Density

The mass per unit length of textile products, such as ropes, lines, cords and twines. In universal counts system, it is expressed in kilotex.

3.11 Moisture Equilibrium

The condition reached by a sample or specimen in a controlled atmosphere when the net difference between the amount of moisture absorbed and the amount desorbed as shown by a change in mass shows no trend and becomes insignificant.

3.12 Moisture Equilibrium for Testing

The condition reached by a sample or specimen during free exposure to moving air, controlled at specified conditions. For test purpose, moisture equilibrium shall be reached by absorption, starting from a relatively low moisture content. Moisture equilibrium for test is considered to have been reached when the rate of increase in mass of a sample or specimen does not exceed prescribed for the materials being tested.

3.13 Pitch (of rope)

Same as 'Length of Lay' (*see* **3.9**).

3.14 Rope

A flexible continuous, yarn twisted from fibres and formed into strands and thereafter those laid into rope usually greater than 4 mm diameter, structurally balanced to maintain compacted form.

3.15 Rope Gauge

An instrument used for measuring the circumference and diameter of the rope (*see* Fig. 3).

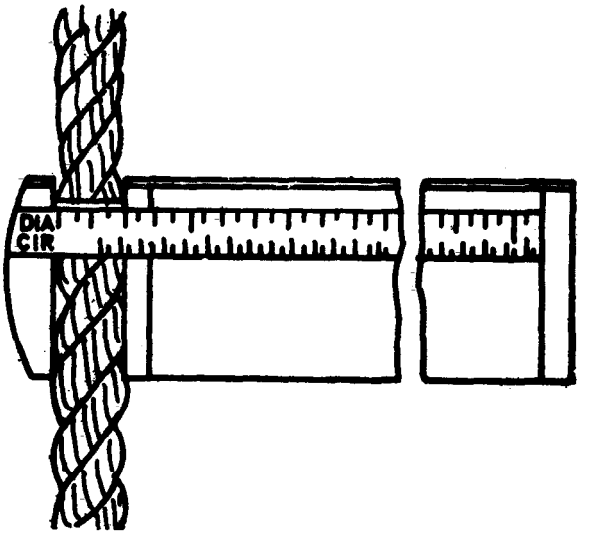

FIG. 3 ROPE GAUGE

3.16 Size of Rope

Circumference or diameter of rope in mm.

4 ATMOSPHERIC CONDITIONS FOR TESTING AND CONDITIONING

4.1 Prior to evaluation, the test sample shall be conditioned to moisture equilibrium in a standard atmosphere at 65 ± 2 percent relative humidity and 27 ± 2°C temperature for 24 hours (*see also* IS 6359 : 1971).

4.2 Tests shall be carried out in standard atmosphere for testing (*see* **4.1**). However, if the arrangement for testing the rope in the standard atmosphere does not exist, the tests may be conducted in prevailing atmospheric conditions as quickly as possible but not exceeding 15 minutes from removal of the test pieces from the conditioning atmosphere.

4.3 If agreed between the buyer and the seller, the conditioning and testing of ropes may be carried out in prevailing atmospheric conditions, and temperature and relative humidity shall be recorded. However, in case of dispute, the tests shall be carried out in standard atmosphere (*see* **4.1** and **4.2**).

5 SAMPLING

Samples shall be so drawn as to be representative of the lot. Samples drawn in accordance with the procedure laid down in the material specification or as agreed to between the buyer and the

seller, shall be held to be representative of the lot. Samples so drawn (number of coils) shall constitute the test samples.

PART 2 DETERMINATION OF MASS, LINEAR DENSITY AND LENGTH

6 APPARATUS

6.1 Balance, capable of weighing to an accuracy of 1 percent.

6.2 Measuring Tape, calibrated in m, cm and mm.

6.3 Tensioning Device

7 PROCEDURE

7.1 Without removing the wrapping material, weigh each coil in the lot to the nearest 1 percent and determine the total gross mass of all the coils in the lot (M_1).

7.2 Take the test sample and determine the gross mass without removing the wrapping material (M_2). Remove the wrapping material except the ties, from the coils and condition them to moisture equilibrium in a standard atmosphere. Weigh each coil in the test sample in g and determine the net conditioned mass of all the coils in the test sample (M_3).

7.3 From one end of each of the coil in the test sample, cut off a piece exactly 2 m in length after applying tension by hand. Mark the coil and the piece so that one can be identified with the other. Weigh the specimen in g. Mark a length of 1 m in the centre of the specimen.

7.4 Take the piece and apply a tension to it as given in the material specification (*see* Note 1 and 2). While the piece is under tension, measure to the nearest mm, the distance between the marks.

NOTES

1 The pre-tension applied should be equal to $D^2/8$ where D is the nominal diameter of the rope in mm. For ready reference and use, the pre-tension values have been given in Table 1.

2 The tension can best be applied in a breaking load testing machine. It can also be applied by fixing one end of the piece to peg running the piece over a pulley and hanging the required weight at the other end. While drawing samples from the coils, care shall be taken to see that it does not take up false twist, kinks, or other deformations.

7.5 Similarly perform the test with other test specimens.

8 CALCULATIONS

8.1 Linear Density

Calculate the linear density by the following formula:

$$T = \frac{m \times d_1}{l \times d_2}$$

where

T = linear density in kilotex,

m = mass of the test piece in g,

d_1 = distance between the marks (1 m),

l = length of the test specimen (2 m), and

d_2 = distance between the marks under tension in m.

Table 1 Pre-Tension Values for Ropes

Nominal Diameter (or Reference Number) mm	Pre-tension			
	Natural Fibre Ropes		Man-Made Fibre Ropes	
	daN (approx)	kgf (approx)	daN (approx)	kgf (approx)
(1)	(2)	(3)	(4)	(5)
4	—	—	2	2
5	—	—	2·9	3
6	—	—	3·9	4
7	—	—	5·9	6
8	11	11	7·8	8
9	—	—	9·8	10
10	14	14	13	13
11	—	—	15	15
12	20	20	16	18
13	—	—	21	21
14	29	30	24	25
16	39	40	29	30
18	49	50	39	40
20	69	70	49	50
22	78	80	59	60
24	88	90	69	70
26	108	110	83	85
28	118	120	93	95
30	137	140	108	110
32	157	160	118	120
36	196	200	147	150
40	235	240	176	180
44	285	290	210	215
48	330	340	240	250
52	390	400	290	295
56	440	450	330	335
60	500	510	380	385
64	570	580	420	430
68	630	640	—	—
72	700	710	530	540
76	750	770	—	—
80	820	840	650	660
88	980	1 000	770	785
96	1 080	1 100	910	925

8.1.1 Similarly calculate the linear density of each coil under test.

8.2 Length of Coil

Calculate the length of coil by dividing the net mass of the coil (M_3) by the linear density of the corresponding coil as obtained in **8.1.**

8.2.1 Similarly calculate the length in each coil under test.

8.3 Mass

If it is desired to determine the net conditioned mass of the lot in addition to the gross mass of the lot (*see* **7.1**), calculate the same by the following:

$$M_C = \frac{M_3}{M_2} \times M_1$$

where

M_C = conditioned mass of the lot,

M_1 = gross mass of the lot (*see* **7.1**),

M_2 = gross mass of coils in the test sample (*see* **7.2**), and

M_3 = conditioned net mass of the coils in the test sample (*see* **7.2**).

9 REPORT

The report shall include the following information:

a) Type of material,

b) Atmospheric conditions,

c) Gross mass of lot,

d) Net mass of lot (if required),

e) Linear density,

f) Length of each coil, and

g) No. of tests.

PART 3 DETERMINATION OF DIAMETER, CIRCUMFERENCE AND LAY

10 APPARATUS

10.1 Rope Gauge or a Pair of Calipers

10.2 Tensioning Device

10.3 Measuring Tape

11 PROCEDURE

11.1 Condition the test sample to moisture equilibrium in the atmosphere for testing after removing the wrapping material except the ties.

11.2 From one end of each of the coils in the test sample, cut off a piece of at least 2 m length. Mark the coil and the piece, so that one can be identified with the another.

11.3 Take one piece and apply a tension to it as given in material specification (*see* Notes 1 and 2).

NOTES

1 The pre-tension applied should be equal to $D^2/8$ where D is the nominal diameter of the rope in mm. For ready reference and use, the pre-tension values have been given in Table 1.

2 The tension can best be applied in the breaking load testing machine. It can also be applied by fixing one end of the piece to the peg, running the piece over a pulley and hanging the required weight at the other end. While drawing samp es from the coils, care shall be taken so that it does not take up false twist, kinks, or other deformations.

11.4 Diameter

While the piece is under tension, measure its diameter to the nearest mm by means of a rope gauge or a pair of calipers of suitable size (or other suitable means) taking care to ensure that the jaws rest on the outside of the strands.

NOTE — Measurement of diameter is not valid in case of 8-strand plaited ropes.

11.5 Circumference

While the piece is still under tension, measure its circumference to the nearest mm by means of a rope gauge or other suitable means.

11.6 Lay

While the piece is still under tension, measure the length (l) in mm of 10 complete turns of the same strand (*see* Fig. 2) or in the case of plaited rope, the length between 10 successive points of plaiting (*see* Fig. 4).

11.6.1 Calculate the lay in mm by the formula:

$$\text{Lay in mm} = \frac{l}{10}$$

where

l = the length between 10 successive points of plaiting.

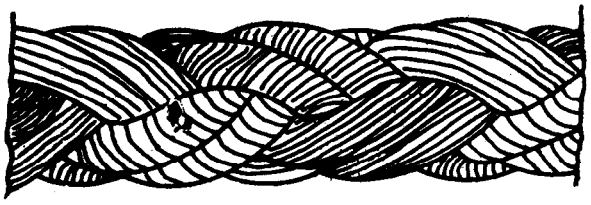

FIG. 4 LAY OF PLAITED ROPE

11.7 Turns per Unit Length

If required, calculate the turns per unit length of the rope by counting the turns in one m while the piece is still under tension.

11.8 Similarly, determine the diameter, circumference, lay and turns per unit length if required, of the remaining coils of the test sample.

12 CALCULATIONS

Calculate the average values for the diameter, circumference, lay and turns per unit length if required, of the remaining coils of the test sample.

13 REPORT

Report shall include the following information:

a) Type of material,
b) Atmospheric conditions for testing,
c) Diameter in mm,
d) Circumference in mm,
e) Length of lay in mm,
f) Turns/m, and
g) No. of tests.

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Amendments Issued Since Publication

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